

# **Characterizing and Scaffolding the Enactment of Adapted Primary Literature Based High-School Biology Curricula**

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## **ABSTRACT**

Primary literature is a genuine text genre of science communication, written by scientists in order to communicate their findings to the scientific community. Adapted primary literature (APL) is an educational text genre that retains the characteristics of primary literature while adapting its content to the comprehension level of high-school students.

My work is the first comprehensive study of the enactment of APL in the naturalistic settings of the classroom, focusing at the same time on both students and teachers. I have developed an APL-based Biotechnology curriculum and a curriculum guide supporting the enactment of an APL-based Developmental Biology curriculum. My study aimed to characterize the class enactment of these curricula and the factors that influence it and are influenced by it. Teachers' instructional strategies and students' benefits and challenges were investigated in the context of the APL-based enactment. An additional important aim was to scaffold the enactment process at the teachers' and students' levels by designing educative curricular materials for teachers, which contain written and visual case studies. The development of these educative materials and the investigation of their impact on the enacting teachers was an additional, practical, aim of this study.

Teaching sessions of different teachers [n=20] enacting the Biotechnology curriculum were video-recorded and transcribed. The class discourse was analyzed at several resolution levels. Post-enactment interviews were performed with the teachers enacting the two APL-based curricula and group interviews were performed with the students of some of their classes [n=97]. The interviews were analyzed using a narrative constructivist procedure for multi-case analysis. I focused my analysis on different samples of teachers enacting each of the two APL-based curricula and possessing different levels of content knowledge and inquiry experience.

My findings indicate that a complex interaction of factors, namely teachers' pedagogical content knowledge, the APL genre and the content of the curriculum, shaped the outcomes of the enactment. The Conversational model developed in the course of this study was found adequate for the enactment of APL and for promoting learning by inquiry. Teachers used diverse instructional strategies depending, among the others, on the part of the curriculum and on the section of the article enacted. A main characteristic

of primary literature and of APL is the different scope and style of the different article sections. The teachers seem to have been able to draw on this characteristic and enhance it by varying their strategies, sometimes reaching a synergistic effect. Even for the enactment of the same article sections, teachers used different enactment models in order to support the different benefits and minimize the respective limitations of each model.

Cognitive and affective engagement, active learning and inquiry thinking were among students' main benefits in the context of APL enactment, as remarked by teachers, students and by our own observations. During the lessons enacted by exemplary teachers, students exhibited different inquiry aspects: they designed an experiment, predicted the experimental results, discussed their practical aspects, they explored the role of the presented methods and their components and suggested alternative methods, and they analyzed the theoretical basis of methods, analyzed graphs and drew conclusions. The students applied a copious number and a high diversity of coordination practices by which they connected elements possessing different epistemic status or located in different contexts: theory, data, experimental stages, text. The coordination practices had an important role in the process of students' meaning-making of the APL text and were associated with the display of inquiry aspects and with students' expressed claims of difficulty.

Students' difficulties were mainly linked to the comprehension of complex, multi-stage, molecular processes and methods that are abundant throughout the curriculum and required the use of previous knowledge in new contexts. Coordination practices were applied both in the context of utterances exposing the difficulties and in the context of discussions that attempted to solve the difficulties. It seems that complex educational contexts like APL, because of the challenges posed, carry the promise of promoting beneficial gains like the performance of coordination practices and inquiry aspects. However, in order for these gains to occur, teachers have to use adequate instructional strategies, thus, stressing the importance of developing suitable scaffolding tools, for both students and teachers. We showed the usability of the curriculum guide for the Developmental biology curriculum and the benefits incurred to teachers by the video-taped case studies included in the guide.